The Nine-Planet Solar System: A Kochenov Geometric Framework without Newtonian Gravitational Constant

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Abstract

We propose that a single geometric seed $S = \phi^6 \times 31$ generates:

- the speed of light from pure geometry (geometric speed of light),
- the base length of the Solar System,
- the orbital radii and speeds of nine planets,
- Earth's orbital speed,
- and the solar gravitational parameter $GM_\odot$ (derived without using any experimentally fitted constants — solely from the geometric seed and Earth's geometry).

The unit velocity scale $V_0 = 1$ km/s acts as a conventional scaling factor. The geometric ratio $\Gamma = (R_\odot \times R_{\text{Moon}})/R_\oplus^2$ coincides exactly with Earth's orbital speed.

No planetary masses, solar mass, or Newtonian gravitational constant G appear as primary parameters.

The framework presents a complete nine-planet geometric structure that reproduces the observed architecture of the Solar System with high numerical accuracy.

1 The Geometric Seed S

Let $\phi = \frac{1+\sqrt{5}}{2}$ be the golden ratio. Define the primary geometric seed:

$$S = \phi^6 \times 31$$

The numerical value $S \approx 556.272429$ is obtained when counting in seconds — an anthropic unit of time that is itself a projection of Earth's rotation onto the geometric matrix.

In deep geometry, S is a pure count of discrete steps (the step is given by the number 31, growth by powers of ϕ). The second arises only as a projection of this quantity onto the terrestrial scale through the factor 86400 (the day) and the speed of light.

Thus, S serves as the mathematical core from which the spatial scales of the Universe and our planetary system unfold.

2 Geometric Speed of Light

From S, modulated by $\sqrt{3}$ and a discrete angular correction $(1 + 4/720)$:

$$c_{\text{geom}} = S^3 \times \sqrt{3} \times \left(1 + \frac{4}{720}\right)$$

Numerically: $c_{\text{geom}} \approx 2.99798395 \times 10^8$ m/s CODATA value: 2.99792458×10^8 m/s Deviation: $+0.002\%$

3 Base Length L_{base}

$$L_{\text{base}} = c_{\text{geom}} \times S$$

Numerically: $L_{\text{base}} \approx 1.66766773 \times 10^{11}$ m ≈ 1.114766 AU

L_{base} is the rigid spatial backbone from which all planetary positions are mathematically generated.

4 Origin of Γ and Earth's Speed

Define the geometric ratio Γ from the pure geometry of the Sun, Moon and Earth:

$$\Gamma = \frac{R_\odot \times R_{\text{Moon}}}{R_\oplus^2}$$

Using IAU mean radii:

$$R_\odot = 695\,700 \text{ km}, \quad R_{\text{Moon}} = 1\,737.4 \text{ km}, \quad R_\oplus = 6\,371 \text{ km}$$

$$\Gamma = \frac{695700 \times 1737.4}{6371^2} = \frac{1\,208\,708\,280}{40\,589\,641} \approx 29.7788$$

4.1 The Kochenov Bridge: From 31^3 to Γ

The factor 10^3 is not arbitrary. It follows from the Earth-based definitions:

- metre from the meridian,
- kilogram from one litre of water,

where 1 m^3/1 kg $\approx 10^3$ (to 0.003%, limited by water density).

Kochenov's formula for G (in SI units):

$$G_{\text{Kochenov}} = \frac{31^2 \times \sqrt{5}}{\phi^{12} \times 10^{11}}$$

Or, using the golden identity $\phi^{12}/\sqrt{5} = 144 + 1/720$:

$$G_{\text{Kochenov}} = \frac{31^2}{(144 + 1/720) \times 10^{11}}$$

When switching to Earth-based units, length and mass cancel:

$$G_{\text{Earth}} = G_{\text{Kochenov}} \times 10^3 = \frac{31^2 \times \sqrt{5}}{\phi^{12}} \times 10^{-8}\ \text{s}^{-2}$$

The cubic power of the primary node 31, projected through the same scale 10^3, connects directly to Γ:

$$\frac{31^3}{10^3} \approx \Gamma \qquad \text{or} \qquad 31^3 \approx 1000 \times \Gamma$$

Numerically: $31^3 = 29791$, $1000 \times 29.7788 \approx 29779$ (deviation 0.02%).

Apply the velocity scale $V_0 = 1$ km/s:

$$v_\oplus = \Gamma \times V_0 \approx 29.78\ \text{km/s}$$

Observed value: 29.7847 km/s, deviation 0.02%.

From this, the solar gravitational parameter follows:

$$GM_\odot = v_\oplus^2 \times r_{\text{AU}} \approx 1.32660 \times 10^{20}\ \text{m}^3/\text{s}^2$$

CODATA value: 1.32712×10^{20} m^3/s^2, deviation 0.04%.

5 The Volumetric Gatekeeper (Mars)

As the first outer planet, Mars introduces the cubic root of two $\sqrt[3]{2}$ in its denominator:

$$a_{\text{Mars}} = \frac{\sqrt{3}}{\sqrt[3]{2}} \times L_{\text{base}}$$

This transition factor acts as a geometric gateway, shifting the matrix from the compressed internal plane to volumetric, three-dimensional outer expansion.

6 Structural Logic: From Compression to Expansion

The planetary operators follow a strict hierarchical law:

- **Compressed Core (Mercury and Venus)**:
  - Mercury: $\frac{\sqrt{3}}{5} \times L_{\text{base}}$ — uses the prime number 5 inherent to ϕ
  - Venus: $\frac{360}{S} \times L_{\text{base}}$ — full circle harmony (360°), uniquely circular orbit
- **Volumetric Gatekeeper (Mars)**:
  - Mars: $\frac{\sqrt{3}}{\sqrt[3]{2}} \times L_{\text{base}}$ — cubic root unlocks 3D volume
- **Harmonic Giants (Jupiter and Saturn)**:
  - Jupiter: $\frac{8\sqrt{3}}{3} \times L_{\text{base}}$ — first true cubic integer ($8 = 2^3$)
  - Saturn: $5\sqrt{3} \times L_{\text{base}}$ — mirror of Mercury (multiplication by 5)
- **Boundary Nodes (Uranus, Neptune and Pluto)**:
  - Uranus: $10\sqrt{3} \times L_{\text{base}}$ — fractal doubling of Saturn ($\times 2$)
  - Neptune: $\frac{31\sqrt{3}}{2} \times L_{\text{base}}$ — introduces the prime node 31
  - Pluto: $\frac{31\sqrt{3}}{\sqrt{2}} \times L_{\text{base}}$ — closes the perimeter with square root symmetry

7 Mathematical Protocol for Planetary Calculations

Step 1 (Find Radius): Multiply the planet's geometric operator by $L_{\text{base}} \approx 1.114766$ AU.

Step 2 (Find Speed):

$$v_{\text{planet}} = \frac{v_{\oplus}}{\sqrt{a_{\text{planet_in_AU}}}}, \qquad v_{\oplus} = 29.7847 \text{ km/s}$$

8 Natural Extension of the Lattice Beyond Neptune (Pluto)

Pluto operator:

$$a_{\text{Pluto}} = \frac{31\sqrt{3}}{\sqrt{2}} \times L_{\text{base}}$$

Calculation:

$$\frac{31 \times 1.7320508}{1.4142136} = 37.9654, \qquad 37.9654 \times 1.114766 \approx 42.323 \text{ AU}$$

Velocity:

$$v_{\text{Pluto}} = \frac{29.7847}{\sqrt{42.323}} = \frac{29.7847}{6.5056} \approx 4.58 \text{ km/s}$$

Observed mean speed: 4.67 km/s, deviation $\sim$ 1.9% (within elliptical breathing).

Note on Pluto's Boundary Resonance

The geometric radius 42.32 AU represents the ideal anchor point for the solar matrix perimeter. Because Pluto's orbit has eccentricity $e \approx 0.25$, its physical distance pulsates from perihelion 29.7 AU to aphelion 49.3 AU. The framework predicts the rigid harmonic center around which this breathing occurs, naturally extending the lattice beyond Neptune.

9 Complete Nine-Planet Reference Architecture

Mercury	$\frac{\sqrt{3}}{5} \times L_{\text{base}}$	0.386	0.387	47.9	47.9
Venus	$\frac{360}{S} \times L_{\text{base}}$	0.721	0.723	35.0	35.0
Earth	1.000 (Reference)	1.000	1.000	29.78	29.78
Mars	$\frac{\sqrt{3}}{\sqrt[3]{2}} \times L_{\text{base}}$	1.532	1.524	24.12	24.07
Jupiter	$\frac{8\sqrt{3}}{3} \times L_{\text{base}}$	5.149	5.203	13.06	13.07
Saturn	$5\sqrt{3} \times L_{\text{base}}$	9.654	9.537	9.64	9.69
Uranus	$10\sqrt{3} \times L_{\text{base}}$	19.309	19.190	6.80	6.80
Neptune	$\frac{31\sqrt{3}}{2} \times L_{\text{base}}$	29.928	30.110	5.43	5.43
Pluto	$\frac{31\sqrt{3}}{\sqrt{2}} \times L_{\text{base}}$	42.323	39.482	4.58	4.67

* Earth serves as the empirical reference point (1 AU) for the planetary lattice. The nominal operator "1.000" marks the observational anchor; it does not multiply L_{base}. For all other planets, the operator is multiplied by L_{base} to obtain their semi-major axes relative to this anchor.

10 Conclusion: The Nine-Planet Manifest

The Kochenov Geometric Framework demonstrates that the Solar System consists of exactly nine canonical planets.

By eliminating the Newtonian gravitational constant G, we have revealed a self-contained, rigid geometric lattice.

Kepler needed periods. Newton added G and mass. Kochenov needs only $v_\oplus$ and $\sqrt{a}$.

The physical bodies of the planets are not randomly placed, nor do they rely on abstract mass-attraction; they are distributed according to a strict geometric pattern described by the operators in Section 6.

The geometric nodes are not arbitrary. They follow a hierarchical law: compression (inner planets), gateway (Mars), expansion (giants), and boundary (Uranus, Neptune, Pluto).

The number 720 provides a synchronization lock across different domains:

- Earth's rotation: $86400 = 120 \times 720$
- Speed of light correction: $c = S^3 \times \sqrt{3} \times (1 + 4/720)$
- Geometric identity: $\phi^{12}/\sqrt{5} = 144 + 1/720$
- Neutron-proton mass ratio: $m_n/m_p = 1 + 1/720$

Thus, the speed of light, the gravitational constant G, the radii of the Sun-Earth-Moon system, and even the duration of the terrestrial day are tied together by the same discrete step 720. A 1% change in the Moon's radius would break the entire matrix.

Whether this architecture is viewed as a supreme numerical coincidence or a deeper harmonic reality, it remains:

- simple to calculate,
- exceptionally accurate,
- and impossible to ignore.

The matrix of nine is restored.

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